Solids Liquids and Gasses 1 Answers

1)

(a) (i) smaller because <u>area</u> smaller B1

(ii) smaller because depth/height smaller ignore less water B1

(b) (i) $h\rho g$ OR $12 \times 1000 \times 10$ C1
1.2×10^5 Pa OR 1.1772×10^5 Pa OR 1.176×10^5 Pa accept N/m^2 A1

(ii) candidate's **(i)** + 1.0×10^5 Pa correctly evaluated with unit (correct value 2.2×10^5) B1

(iii) $p_1V_1 = p_2V_2$ in any form C1
1.1 cm^3
OR $0.5 \times$ candidate's **(ii)**/10^5 correctly evaluated A1

(iv) value in **(iii)** too small OR volume larger o.w.t.t.e. B1 [8]

2)

(a) (i) (Molecules) move randomly / in random directions
(Molecules) have high speeds
(Molecules) collide with each other / with walls B1

(ii) (Force is caused by) collision (and rebound) of molecules (with the walls) o.w.t.t.e C1

(iii) $p = F/A$ OR (force =) pA OR 300×0.12 C1
OR $300\,000 \times 0.12$
OR any other recognisable pressure × area
= 36 kN / 36 000 N A1

(b) (i) $p_1V_1 = p_2V_2$ / 300×0.1 (× 0.12) = $p_2 \times 0.05$ (× 0.12)
OR if V is halved, p is doubled OR vice versa C1

p_2 = 600 kPa A1

(ii) (molecules) collide <u>with walls</u> more often o.w.t.t.e.
OR more collisions <u>with walls</u> per second or per unit time o.w.t.t.e B1 [7]

3)

(a) surfaces shown at realistic levels in dish and tube AND vertical height h between levels clearly shown B1
top label: vacuum / mercury vapour B1
bottom label: mercury B1

(b) (P =) hdg OR $0.73 \times 13600 \times 10$ C1
99280 Pa at least 2 s.f. B1

(c) one from:
abnormal weather / atmospheric conditions o.w.t.t.e.
air in space above mercury in tube
barometer is in a high altitude location o.w.t.t.e.
space above mercury is not a vacuum B1 [6]
ignore atmospheric pressure varies ignore temperature

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4)

(a) (i) most: gas
least: solid both required — B1

(ii) because change of pressure (also) causes volume change (in a gas) — B1
NOT 'gas can be compressed'

(b) (i) two from:
expands uniformly (over required range)
remains liquid over required range
expands more than glass / has high expansivity / expansion
has (reasonably) low specific heat capacity.
has low freezing point / lower freezing point than mercury — max B2

(ii) make (capillary) tube narrower (and longer) / thinner / smaller diameter — B1
make bulb larger (and tube longer) — B1
allow 'bore' for tube ignore 'smaller' ignore narrow thermometer

(c) allows fast(er) flow of heat to / from alcohol
OR allows fast response (to temperature change)
OR because glass is a poor conductor / good insulator (so needs to be thin for fast response)
OR heat transfer more efficient / faster
OR glass takes up less heat — B1 [7]
ignore reference to sensitivity ignore 'easier'

5)

(a) ρgh in symbols, words or numbers — C1
700 Pa or N/m^2 — A1 [2]

(b) use of $F = pA$ — C1
14.7 N ecf from **(a)** — A1 [2]

(c) (30.9 – 14.7 =)16.2 N OR evidence of calculation of resultant — C1
use of $a = F/m$ — C1
5.24 m/s^2 — A1 [3]

6)

(a) molecules/atoms move more slowly — B1
fewer collisions OR less hard collisions with walls / balloon — B1
lower pressure — B1 [3]

(b) larger surface area of walls OR atoms further apart OR atoms travel further — B1
fewer collisions with walls/balloon (only penalise missing walls once in **(a)** or **(b)**) — B1
lower pressure — B1 [3]

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7)

(a) **(i)** (P =) F/A words or symbols — B1

(ii) 22 500 Pa — B1

(b) less pressure — B1
less sinking — B1

(c) any suggestion which involves increasing the area in contact with the ice
e.g. snow shoes / skis — B1 [5]

8)

(a) (p =) F/A OR in words OR 90/4.8 OR 90 / 0.00048 — C1
= 18.75 N/cm^2 OR 1.875×10^5 Pa OR 187500 Pa
OR 187.5 kPa OR 0.1875 MPa at least 2 s.f. — A1

(b) Area of Y bigger (than area of X so force greater) — B1

(c) Volume of oil moved at Y = volume of oil moved at X — B1
Area of Y × distance moved by Y = Area of X × distance moved by X (so distance move by Y smaller) — B1
OR
Work done by piston X = work done on piston Y — (B1)
Work = force × distance and F_2 is greater than F_1 so distance moved by Y smaller (than distance moved by X) — (B1)

(d) Air bubbles compress when pressure applied — M1
More movement of piston X required for same movement of piston Y
OR Y moves less (for same movement of X)
OR Driver must push the brake pedal further / do more work
OR Pressure reduced / force on Y reduced
OR System is less efficient — A1

[Total: 7]

9)

(a) **(i)** Glass / flask receives heat / rises in temperature — B1
Glass / flask expands — B1

(ii) Heat flows through glass to water OR Water receives heat / thermal energy from / conducted by glass OR Water temperature <u>rises</u> OR Water molecules move faster / gain K.E. — B1
Water expands / Water molecules move further apart — B1

(iii) Glass / solid expands less OR water / liquid expands more — B1

(b) Use a bigger flask OR a narrower tube
OR Use a solid <u>and</u> a liquid that expand more — B1

[Total: 6]

10) **(a)** 76 (cm Hg) B1

(b) 60 – 50 C1
candidate's **(a)** + or – 10 e.c.f. C1
86 (cm Hg) c.a.o. A1

(c) L.H. goes up B1
R.H. goes down B1

[Total: 6]

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